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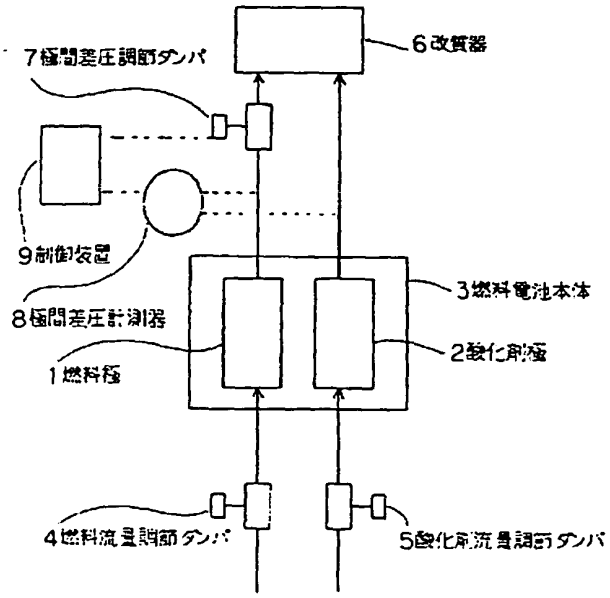
(54)【発明の名称】　燃料電池発電プラント

(57)【要約】
【課題】　いかなる運転状況においても、極間差圧を全てのセル面でプラスとなる理想的な低い値に維持し、それによって電池の特性劣化を防止する。
【解決手段】　燃料電池発電プラントは、燃料極１と酸化剤極２からなる燃料電池本体３、燃料極１に燃料を供給する燃料流量調節ダンパ４、酸化剤極２に酸化剤を供給する酸化剤流量調節ダンパ５を有し、さらに、燃料極１の出口に設けられて極間差圧を調節する極間差圧調節ダンパ７、および燃料極１と酸化剤極２の出口の極間差圧を計測する極間差圧計測器８を有する。電池出口の極間差圧設定値（極間差圧の適正値）ΔＰは、固定でなく、制御装置９により随時設定される。制御装置９は、極間差圧計測器８による差圧の計測値がその時点における極間差圧設定値ΔＰとなるようにして極間差圧調節ダンパ７を可変制御する。



【特許請求の範囲】
【請求項１】　燃料極と酸化剤極からなる燃料電池本体と、前記燃料極に燃料を供給する燃料供給手段と、前記酸化剤極に酸化剤を供給する酸化剤供給手段を有し、さらに、前記燃料極と前記酸化剤極との間の差圧を計測する計測手段と、前記燃料極と前記酸化剤極との間の差圧を調節する調節手段を有する燃料電池発電プラントにおいて、
前記燃料電池本体内を流れる燃料流量と酸化剤流量の両方に基づいて前記燃料極と前記酸化剤極との間の差圧の適正値を設定する設定手段を備えたことを特徴とする燃料電池発電プラント。
【請求項２】　燃料極と酸化剤極からなる燃料電池本体と、前記燃料極に燃料を供給する燃料供給手段と、前記酸化剤極に酸化剤を供給する酸化剤供給手段を有し、さらに、前記燃料極と前記酸化剤極との間の差圧を計測する計測手段と、前記燃料極と前記酸化剤極との間の差圧を調節する調節手段を有する燃料電池発電プラントにおいて、
前記燃料電池本体内を流れる燃料流量と酸化剤流量の中から選択された一方の流量に基づいて前記燃料極と前記酸化剤極との間の差圧の適正値を設定する設定手段を備えたことを特徴とする燃料電池発電プラント。
【請求項３】　前記調節手段を、前記燃料極と前記酸化剤極との間の差圧が前記設定手段で設定された適正値となるように制御する制御手段を備えたことを特徴とする請求項１または請求項２記載の燃料電池発電プラント。
【請求項４】　前記設定手段と前記制御手段を兼ねる単一の手段を備えたことを特徴とする請求項１から請求項３までのいずれか一つに記載の燃料電池発電プラント。
【請求項５】　燃料極と酸化剤極からなる燃料電池本体と、前記燃料極に燃料を供給する燃料供給手段と、前記酸化剤極に酸化剤を供給する酸化剤供給手段を有し、さらに、前記燃料極と前記酸化剤極との間の差圧を計測する計測手段と、前記燃料極と前記酸化剤極との間の差圧を調節する調節手段を有する燃料電池発電プラントにおいて、
前記燃料極と前記酸化剤極の中のいずれか一方の電極の出口と他方の電極の入口との間の差圧を計測する計測手段を備えたことを特徴とする燃料電池発電プラント。
【請求項６】　燃料極と酸化剤極からなる燃料電池本体と、前記燃料極に燃料を供給する燃料供給手段と、前記酸化剤極に酸化剤を供給する酸化剤供給手段を有し、さらに、前記燃料極と前記酸化剤極との間の差圧を計測する計測手段と、前記燃料極と前記酸化剤極との間の差圧を調節する調節手段を有する燃料電池発電プラントにおいて、
前記燃料極の出口と前記酸化剤極の入口との間の差圧と、前記燃料極の入口と前記酸化剤極の出口との間の差圧を計測する計測手段を備えたことを特徴とする燃料電池発電プラント。
【請求項７】　前記計測手段で計測される計測値を監視し、この計測値が適正な範囲に維持されるようにして前記調節手段を制御する制御手段を備えたことを特徴とする請求項５または請求項６記載の燃料電池発電プラント。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、燃料電池発電プラントに関し、特に、極間差圧を計測・管理するための構成の改良に関する。
【０００２】
【従来の技術】一般に、燃料電池発電プラントでは、安定した発電を行う目的から、何らかの手段によって燃料極と酸化剤極の差圧（極間差圧）を一定に維持するように管理している。通常は、両極の出口の差圧の計測を行っており、その値を一定値またはある一定の範囲内に維持するように何らかの手段を講じている。
【０００３】図３は、従来の燃料電池発電プラントの一例を示す構成図である。この図３に示すように、燃料電池発電プラントはまず、燃料極１と酸化剤極２からなる燃料電池本体３、燃料極１に燃料を供給する燃料流量調節ダンパ４、および酸化剤極２に酸化剤を供給する酸化剤流量調節ダンパ５を有する。燃料電池発電プラントはまた、燃料または酸化剤を処理する改質器６、燃料極１の出口に設けられて極間差圧を調節する極間差圧調節ダンパ７、および燃料極１と酸化剤極２の出口の極間差圧を計測する極間差圧計測器８を有する。
【０００４】以上のような構成を有する燃料電池発電プラントの運転時には、燃料流量調節ダンパ４と酸化剤流量調節ダンパ５により、燃料電池本体３の燃料極１と酸化剤極２に燃料と酸化剤がそれぞれ供給される。また、燃料電池本体３の余剰ガスは、改質器６で混合燃焼される。そして、このような運転時においては、極間差圧調節ダンパ７や極間差圧計測器８などにより、燃料電池本体３の燃料極１の出口の圧力と酸化剤極２の出口の圧力との差圧が、一定の範囲内に維持されるように調節される。この極間差圧は、具体的には、燃料極１の圧力から酸化剤極２の圧力を差し引いた差圧として求められ、通常の場合、この極間差圧の調節は、僅かにプラスとなる（燃料極１側の圧力の方が高くなる）ようにして行われる。
【０００５】
【発明が解決しようとする課題】以上のような従来の燃料電池発電プラントにおいて、極間差圧計測器８の計測点である電池出口の極間差圧を、意図する範囲内に維持するように調節することは比較的容易である。
【０００６】しかしながら、実際には、電池出口の極間差圧は、燃料電池本体３の全ての箇所の極間差圧に相当するものではない。すなわち、燃料電池本体３は、複数

の単セルを重ね合わせて構成されているが、その各セル面の極間差圧は全面に亘って均一ではなく、ガスの圧力損失の影響で部分的に異なっている。このようなセル面における極間差圧のばらつきは、運転状況によって変わるが、典型的には数十mmAq程度異なっている。

【０００７】図４は、このようなセル面の極間差圧の分布の一例を示す説明図である。図中１０は燃料電池本体のセルを表している。１１は燃料入口、１２は燃料出口であり、矢印１３に示すようにして燃料入口１１から燃料がセル１０内に導入され、燃料出口１２から導出される。また、１４は酸化剤入口、１５は酸化剤出口であり、矢印１６に示すようにして酸化剤入口１４から酸化剤がセル内に導入され、酸化剤出口１５から導出される。このようなセル１０において、通常の場合、極間差圧の計測点は、電池出口側、すなわち、燃料出口１２側かつ酸化剤出口１５側のエリアＡ１である。その一方で、このようなセル１０においては、電池内での圧力損失の関係上、燃料入口１１側における酸化剤出口１５側のエリアＡ２では極間差圧が最も高くなり、燃料出口１２側における酸化剤入口１４側のエリアＡ３では最も低くなる。

【０００８】すなわち、この図４のセル１０においては、電池出口側のエリアＡ１の極間差圧を例えば５０mmAqに管理していたとしても、エリアＡ２での極間差圧は５０mmAqより高く、エリアＡ３では５０mmAqより低くなっていることになる。前述したように、燃料電池の極間差圧はわずかにプラスとなる（燃料極１側の圧力の方が高くなる）ことが理想的であるが、このようにエリアＡ１を計測・管理した場合には、エリアＡ３の極間差圧がマイナスとなる（酸化剤極２側の圧力の方が高くなる）可能性がある。

【０００９】図５は、以上の問題点をさらに別な角度から示す図であり、燃料電池本体３の電池入口から改質器６までに至る燃料ラインと酸化剤ラインの各圧力分布２１，２２の一例を示すグラフである。ここで、各箇所の極間差圧は、各箇所における燃料ラインの圧力と酸化剤ラインの圧力の差として示されている。そして、この図５の２３に示すように、極間差圧調節ダンパ７によって、燃料ラインの圧力が調節されており、それにより、極間差圧計測点の極間差圧Ｐ１の値が一定となるように制御されている。

【００１０】しかし、前述したとおり、この場合の極間差圧Ｐ１は、電池出口側のセル１０の一部、すなわち、図４のエリアＡ１の極間差圧に過ぎず、セル１０の内部では、最高値Ｐ２と最低値Ｐ３を両端とする極間差圧分布が生じている。この場合、最高値Ｐ２は図４のエリアＡ２の極間差圧であり、最低値Ｐ３は図４のエリアＡ３の極間差圧である。特に、極間差圧の設定値が低い場合には、部分的に極間差圧がマイナスとなる（酸化剤極２側の圧力の方が高くなる）可能性がある。すなわち、図５に示す最低値Ｐ３がマイナスとなる可能性がある。

【００１１】ここで、仮に、セル面の一部の極間差圧がマイナスになった場合にはその部分の特性劣化が急速に進むため、極間差圧がマイナスになることは絶対に避けなくてはならない。しかし、上記のように、電池出口側のエリアＡ１の極間差圧を制御している限り、特に、高負荷において酸化剤の流速が上がると、セル内での極間差圧の偏差が大となり、電池出口の極間差圧設定値が低い場合には、局部的に極間差圧がマイナスになる（酸化剤極２側の圧力の方が高くなる）可能性がある。ある例では、このセル内での極間差圧の差が、７０％負荷で約６０mmAqとなるものと推定されているが、通常は、電池出口側の極間差圧計測点（エリアＡ１）の極間差圧Ｐ１の値が５０mmAqとなるように制御しているため、局部的に極間差圧がマイナスとなる可能性が高い。

【００１２】また、以上のように、極間差圧がマイナスとなると電池の劣化が急速に進むため、そのような事態は絶対に避ける必要があるが、その一方で、極間差圧が高すぎても、場合によっては電池の寿命を短くする可能性がある。すなわち、局部的に極間差圧がマイナスとなるようなＭＡＸ条件までを考慮したマージンを十分に取って電池出口の極間差圧設定値を高く設定した場合には、通常時に極間差圧を無駄に高くすることになり、電池の特性に悪影響を与えることになる。そのため、極間差圧は、セルの全面でプラスとなり、しかもできる限り低い値に制御されることが理想的であるが、図３に示すような従来の燃料電池発電プラントにおいては、そのような理想的な制御を行うことは困難である。

【００１３】本発明は、以上のような従来の問題点を解決するために提案されたものであり、その目的は、いかなる運転状況においても、極間差圧を全てのセル面でプラスとなる理想的な低い値に容易に維持可能であり、それによって電池の特性劣化を防止可能な、信頼性の高い燃料電池発電プラントを提供することである。

【００１４】

【課題を解決するための手段】本発明による燃料電池発電プラントは、燃料極と酸化剤極からなる燃料電池本体と、前記燃料極に燃料を供給する燃料供給手段と、前記酸化剤極に酸化剤を供給する酸化剤供給手段を有し、さらに、前記燃料極と前記酸化剤極との間の差圧を計測する計測手段と、前記燃料極と前記酸化剤極との間の差圧を調節する調節手段を有する燃料電池発電プラントにおいて、前記燃料極と前記酸化剤極との間の差圧を計測・管理する方式に、次のような特徴を有するものである。

【００１５】請求項１記載の燃料電池発電プラントは、燃料電池本体内を流れる燃料流量と酸化剤流量の両方に基づいて前記燃料極と前記酸化剤極との間の差圧の適正値を設定する設定手段を備えたことを特徴としている。

【００１６】以上のような構成を有する請求項１記載の燃料電池発電プラントによれば、次の作用が得られる。

まず、通常、極間差圧は約５０mmAq程度となるように管理されているが、前述したように、従来管理されている極間差圧は、燃料極・酸化剤極の出口における極間の差圧であって、セル内部での各部の極間差圧とは厳密には一致していない。そして、単に燃料極・酸化剤極の出口における極間差圧を約５０mmAq程度となるように管理した場合には、実際のセル内部での極間差圧は、局部的にマイナスになる可能性がある。

【００１７】これに対して、請求項１の発明においては、設定手段によって、燃料と酸化剤の流量から生じる圧力損失を計算し、その状況において最も適切な極間差圧の値を適正値として設定することにより、局部的に極間差圧がマイナスになることを防止することができる。この場合、最も適切な値とは、安定運転時にセル全面において極間差圧がプラスとなる値の最低値（ミニマム）である。

【００１８】すなわち、本発明においては、設定手段によって、燃料と酸化剤の流量に基づいて極間差圧の適正値を常時設定できるため、燃料極・酸化剤極の出口における極間差圧がこの適正値となるような管理・運用を行うことにより、全セル面の極間差圧をプラスかつミニマムとなるように維持することが可能となる。

【００１９】請求項２記載の燃料電池発電プラントは、前記燃料電池本体内を流れる燃料流量と酸化剤流量の中から選択された一方の流量に基づいて前記燃料極と前記酸化剤極との間の差圧の適正値を設定する設定手段を備えたことを特徴としている。

【００２０】以上のような構成を有する請求項２記載の燃料電池発電プラントによれば、燃料と酸化剤の一方の流量に基づいて極間差圧の適正値を設定するため、燃料と酸化剤の両方の流量に基づいて極間差圧の適正値を設定する請求項１記載の発明に比べて適正値の精度が若干低下するものの、同様の作用を得ることができる。ただし、流量を計測しない側のガスについては、電流値からガス消費量を計算し、圧力損失補正に使用する。本発明は、特に、計測機器やコストの制約がある場合には、請求項１記載の発明よりも有効である。

【００２１】請求項３記載の燃料電池発電プラントは、請求項１または２記載の燃料電池発電プラントにおいて、前記調節手段を、前記燃料極と前記酸化剤極との間の差圧が前記設定手段で設定された適正値となるように制御する制御手段を備えたことを特徴としている。

【００２２】以上のような構成を有する請求項３記載の燃料電池発電プラントによれば、制御手段によって極間差圧を自動的に制御できるため、全セル面の極間差圧を常時かつ確実にプラスかつミニマムとなるように維持することができる。

【００２３】請求項４記載の燃料電池発電プラントは、請求項１～３記載の燃料電池発電プラントにおいて、前記設定手段と前記制御手段を兼ねる単一の手段を備えたことを特徴としている。以上のような構成を有する請求項４記載の燃料電池発電プラントによれば、プラント全体を簡略化できる。

【００２４】請求項５記載の燃料電池発電プラントは、前記燃料極と前記酸化剤極の中のいずれか一方の電極の出口と他方の電極の入口との間の差圧を計測する計測手段を備えたことを特徴としている。

【００２５】以上のような構成を有する請求項５記載の燃料電池発電プラントによれば、計測手段によって、燃料極出口と酸化剤極入口との間の差圧または燃料極入口と酸化剤極出口との間の差圧を計測し、その計測値が適切な値となるような管理・運用を行うことにより、局部的に極間差圧がマイナスになることを防止することができる。

【００２６】すなわち、計測手段によって燃料極出口と酸化剤極入口との間の差圧を計測する場合には、セル内での極間差圧最低値を計測することになるため、この値がプラスかつミニマムとなるような管理・運用を行うことで、セル内の全ての箇所の極間差圧をプラスかつミニマムとすることができる。また、計測手段によって燃料極入口と酸化剤極出口との間の差圧を計測する場合には、逆にセル内の極間差圧最高値を計測することになるため、より厳密な燃料電池特性の評価および運転最高点の設定が可能となる。

【００２７】請求項６記載の燃料電池発電プラントは、前記燃料極の出口と前記酸化剤極の入口との間の差圧と、前記燃料極の入口と前記酸化剤極の出口との間の差圧を計測する計測手段を備えたことを特徴としている。

【００２８】以上のような構成を有する請求項６記載の燃料電池発電プラントにおいては、計測手段によって燃料極出口と酸化剤極入口との間の差圧を計測することにより、セル内での極間差圧最低値を計測することができるため、この値がプラスかつミニマムとなるような管理・運用を行うことで、セル内の全ての箇所の極間差圧をプラスかつミニマムとすることができる。また、計測手段によって燃料極入口と酸化剤極出口との間の差圧を計測することにより、逆にセル内の極間差圧最高値を計測することができるため、より厳密な燃料電池特性の評価および運転最高点の設定が可能となる。

【００２９】請求項７記載の燃料電池発電プラントは、請求項５または６記載の燃料電池発電プラントにおいて、前記計測手段で計測される計測値を監視し、この計測値が適正な範囲に維持されるようにして前記調節手段を制御する制御手段を備えたことを特徴としている。

【００３０】以上のような構成を有する請求項７記載の燃料電池発電プラントによれば、制御手段によってセル内での極間差圧最低値または極間差圧最高値あるいはその両方を自動的に制御できるため、全セル面の極間差圧を常時かつ確実にプラスかつミニマムとなるように維持することができる。

【００３１】
【発明の実施の形態】以下には、本発明による燃料電池発電プラントの複数の実施の形態について、図１および図２を参照して説明する。なお、図３に示した従来例と同一部分には同一符号を付し、説明を省略する。
【００３２】［１．第１の実施の形態］
［１－１．構成］図１は、本発明による第１の実施の形態として、請求項１、３、４記載の各発明を適用した燃料電池発電プラントの一つの実施の形態を示す構成図である。この図１に示すように、本実施の形態において、図２の従来例と異なる点は、極間差圧調節ダンパ７を制御する制御装置（制御手段）９を持ち、この制御装置９によって極間差圧の可変制御を行うように構成した点である。ここで、制御装置９は、極間差圧の適正値を設定する設定手段を兼ねている。また、本実施の形態において、極間差圧計測器８は、極間差圧として、従来のプラントと同様に、燃料極１と酸化剤極２の出口間の極間差圧を測定するように構成されている。
【００３３】また、電池出口の極間差圧の管理・運用の基準となる電池出口の極間差圧設定値は、従来は一定の値または一定の範囲として固定的に設定されている。これに対し、本実施の形態において、このような電池出口の極間差圧設定値（極間差圧の適正値）ΔＰは、固定でなく、制御装置９により、次の式（１）にしたがって随時設定される。
【００３４】
【数１】

$$\Delta P = C1 - C2 \times (\text{燃料流量})^{C4} + C3 \times (\text{酸化剤流量})^{C4} \quad \cdots \text{式（１）}$$

なお、この式（１）において、Ｃ１は制御幅による値で約２０㎜Aqである。また、Ｃ２は燃料流量による圧力損失補正係数であり、後述するＣ３に比べ小さい。そして、Ｃ３は酸化剤流量による圧力損失を補正する係数であり、この式では支配的な係数である。また、Ｃ４はセル内での流量と圧力損失に関係する係数であり、１以上２以下の数である。なお、これらの係数は、セルの圧力損失特性から計算によって求められる。
【００３５】［１－２．作用］以上のような構成を有する第１の実施の形態によれば、次の作用が得られる。まず、前述したとおり、従来の燃料電池発電プラントにおいては、特に酸化剤の流速が上がると、セル内での極間差圧の偏差が大となり、電池出口の極間差圧設定値が低い場合には、局部的に極間差圧がマイナスになる（酸化剤極２側の圧力の方が高くなる）可能性がある。しかし、そのＭＡＸ条件までを考慮したマージンを十分に取った電池出口極間差圧の設定では、通常時に極間差圧を無駄に高くすることになり、電池の特性に悪影響を与えることになる。
【００３６】これに対して、本実施の形態においては、燃料または酸化剤の流量が変化した場合には、その流量バランスに応じて、制御装置９により、前記の式（１）にしたがって電池出口の極間差圧設定値ΔＰが求められ、新たに設定される。すなわち、流量バランスの変化に応じて、極間差圧設定値ΔＰが随時変化する。そして、制御装置９は、極間差圧計測器８によって計測される差圧の計測値が、その時点において設定されている極間差圧設定値ΔＰとなるようにして、極間差圧調節ダンパ７を可変的に制御する。
【００３７】このように、本実施の形態においては、制御装置９により、燃料と酸化剤の流量に基づいて状況に応じた極間差圧設定値（極間差圧の適正値）ΔＰを常時設定し、実際の極間差圧がこの極間差圧設定値ΔＰとなるように自動的に制御できるため、全セル面の極間差圧を常時かつ確実にプラスかつミニマムとなるように維持することができる。
【００３８】［１－３．効果］以上のように、本実施の形態によれば、いかなるプラントの状態（負荷、バランスなど；トランジェント時は除く）においても、全セル内での極間差圧をプラスかつミニマムに維持することができる。したがって、電池の特性を急速に劣化させることがないため、電池の寿命を延ばすことができ、燃料電池発電プラントの信頼性を従来に比べて飛躍的に向上することができる。また、設定手段と制御手段を兼ねた制御装置９を使用しているため、プラント全体を簡略化できる。
【００３９】［１－４．変形例］第１の実施の形態の変形例としては、例えば、請求項２記載の発明を適用して、燃料流量と酸化剤流量のいずれか一方のみに基づいて電池出口の極間差圧設定値ΔＰを求める構成も可能である。このように構成した場合には、燃料流量と酸化剤流量の両方に基づいて極間差圧設定値ΔＰを求める場合に比べて設定値ΔＰの精度が若干低下するものの、ほぼ第１の実施の形態と同様の作用効果を得ることができる。ただし、流量を計測しない側のガスについては、電流値からガス消費量を計算し、圧力損失補正に使用することになる。このように、一方の流量のみを利用する場合には、計測機器を簡略化できるため、特に、計測機器やコストの制約がある場合には第１の実施の形態よりも有効である。
【００４０】また、第１の実施の形態においては、設定手段と制御手段を兼ねた単一の制御装置９を使用したが、個別の設定手段と制御手段を使用する構成も可能である。さらに、これに関連して、実際の機器構造としては、設定手段や制御手段を、計測手段あるいは調節手段の一部として組み込んだり、これらの手段を選択的に組

み合わせた装置を構成することなどが考えられる。

【００４１】［２．第２の実施の形態］

［２－１．構成］図２は、本発明による第２の実施の形態として、請求項５、７記載の各発明を適用した燃料電池発電プラントの一つの実施の形態を示す構成図である。この図２に示すように、本実施の形態において、前記第１の実施の形態と異なる点は、極間差圧計測器８の接続箇所である。極間差圧計測器８は、前記第１の実施の形態においては図１に示すように、燃料極１の出口と酸化剤極２の出口に極間差圧計測器８が接続されていたが、本実施の形態では、燃料極１の出口と酸化剤極２の入口に接続されており、この間の差圧を計測するように構成されている。そして、制御装置９は、この極間差圧計測器８からの差圧の計測値が予め設定された一定値（２０mmAq）となるように、極間差圧調節ダンパ７を制御するように構成されている。

【００４２】［２－２．作用］以上のような構成を有する第２の実施の形態によれば、次の作用が得られる。まず、通常の安定運転中における燃料電池発電プラントの制御振幅特性は、±１５mmAq程度であると予想される。よって、極間差圧計測器８の指示値を２０mmAqに制御することにより、通常の安定運転時においては、極間差圧計測器８の指示値をゼロmmAq以上に維持することができる。この場合、本実施の形態における極間差圧の計測点は、セル内での極間差圧の最低点であるため、この計測点における計測値がゼロmmAq以上であるということは、セル内の全ての箇所において、ゼロmmAq以上を維持できることになる。したがって、局部的に極間差圧がマイナスになる（酸化剤極２側の圧力の方が高くなる）ことを防止でき、全セル面の極間差圧を常時かつ確実にプラスかつミニマムとなるように維持することができる。

【００４３】［２－３．効果］以上のように、本実施の形態によれば、前記第１の実施の形態と同様に、いかなるプラントの状態（負荷、バランスなど；トランジェント時は除く）においても、全セル内での極間差圧をプラスかつミニマムに維持することができる。したがって、電池の特性を急速に劣化させることがないため、電気の寿命を延ばすことができ、燃料電池発電プラントの信頼性を従来に比べて飛躍的に向上することができる。

【００４４】［２－４．変形例］第２の実施の形態の変形例としては、例えば、極間差圧計測器８を、第２の実施の形態とは逆に、燃料極１の入口と酸化剤極２の出口に接続し、この間の差圧を計測するように構成することが可能である。このように構成した場合には、極間差圧の計測点が、セル内での極間差圧の最高点となるため、より厳密な燃料電池特性の評価および運転最高点の設定が可能となる。

【００４５】また、請求項６記載の発明を適用して、燃料極１の出口と酸化剤極２の入口との差圧、および燃料極１の入口と酸化剤極２の出口との差圧の両方を計測するように構成した場合には、前記第２の実施の形態の作用効果とその前記変形例の作用効果を合わせた作用効果を得ることができる。

【００４６】［３．他の実施の形態］なお、本発明は、前記各実施の形態およびその変形例に限定されるものではなく、本発明の範囲内で、他にも多種多様な形態を実施可能である。例えば、図１および図２においては、本発明における要部の構成のみを概略的に図示したが、実際の燃料電池発電プラントにおいては、他にも各種の機器やシステムが使用されている。また、燃料電池本体、燃料供給手段、酸化剤供給手段、計測手段、調節手段、設定手段、および制御手段などの具体的な構成は、自由に選択可能である。

【００４７】

【発明の効果】以上説明したように、本発明によれば、燃料流量や酸化剤流量に基づいて極間差圧の適正値を設定するか、あるいは、セル内における極間差圧の最低値または最高値を計測することにより、いかなる運転状況においても、極間差圧を全てのセル面でプラスとなる理想的な低い値に容易に維持可能であり、それによって電池の特性劣化を防止可能な、信頼性の高い燃料電池発電プラントを提供することができる。

【図面の簡単な説明】

【図１】本発明による第１の実施の形態の燃料電池発電プラントを示す構成図。

【図２】本発明による第２の実施の形態の燃料電池発電プラントを示す構成図。

【図３】従来の燃料電池発電プラントの一例を示す構成図。

【図４】一般的な燃料電池のセル面における極間差圧分布の一例を示す説明図。

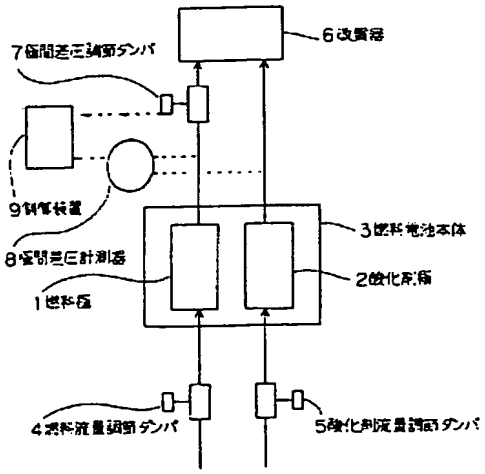
【図５】燃料ラインと酸化剤ラインの各圧力分布の一例を示すグラフ。

【符号の説明】

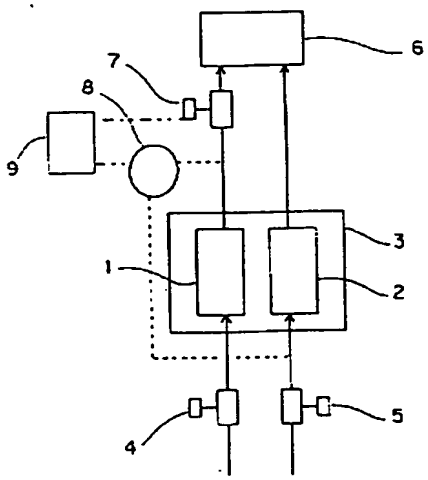
１：燃料極
２：酸化剤極
３：燃料電池本体
４：燃料流量調節ダンパ、
５：酸化剤流量調節ダンパ
６：改質器
７：極間差圧調節ダンパ
８：極間差圧計測器
９：制御装置
１０：セル
１１：燃料入口
１２：燃料出口
１３：燃料の流れ
１４：酸化剤入口
１５：酸化剤出口
１６：酸化剤の流れ

Ａ１：（電池出口の極間差圧計測値と極間差圧が等しい）エリア
Ａ２：（セル内で極間差圧が最高となる）エリア
Ａ３：（セル内で極間差圧が最低となる）エリア
２１：燃料ライン圧力分布
２２：酸化剤ライン圧力分布
２３：極間差圧調節ダンパによる圧力調節箇所
Ｐ１：極間差圧計測点の極間差圧
Ｐ２：セル内部の極間差圧最高値
Ｐ３：セル内部の極間差圧最低値

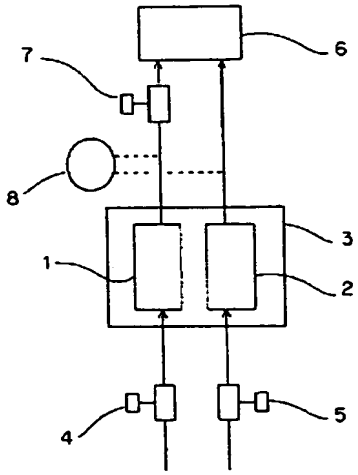
【図１】



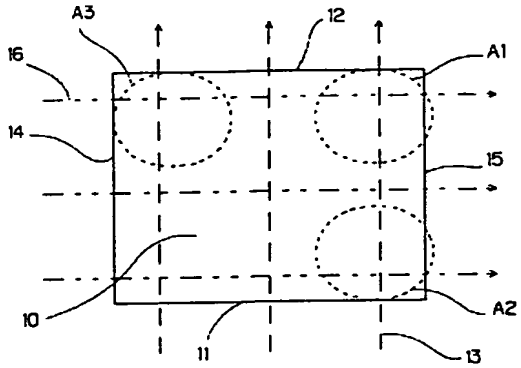
【図２】



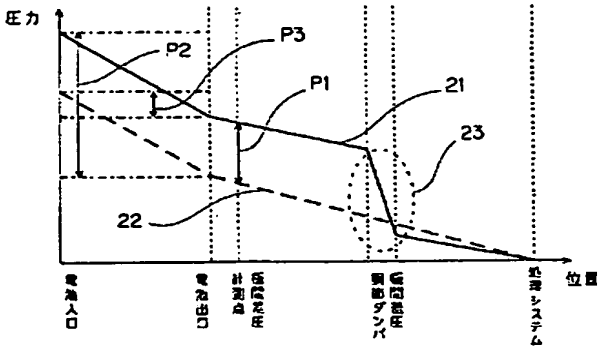
【図３】



【図４】



【図５】



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Bibliography.

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Summary.

(57) [Abstract]
[Technical problem] In any operation situations, between differential pressure is maintained very much to all the ideal low values that are added in respect of a cell, and property degradation of a cell is prevented by it.
[Means for Solution] A fuel cell power generating plant has the fuel cell main part 3 which consists of a fuel electrode 1 and an oxidizer pole 2, the fuel-flow regulation damper 4 which supplies fuel to a fuel electrode 1, and the oxidizer flow regulation damper 5 which supplies an oxidizer to the oxidizer pole 2, and has the differential pressure regulation damper 7 between poles which is formed in the outlet of a fuel electrode 1 and adjusts between differential pressure very much further, and the differential pressure measuring instrument 8 between poles of the outlet of a fuel electrode 1 and the oxidizer pole 2 which measures between differential pressure very much. Differential pressure set point (very proper value of between differential pressure) deltaP is set up at any time not by fixation but by the control unit 9 very between cell outlets. A control unit 9 carries out adjustable control of the between differential pressure regulation damper 7 very much, as the measurement value of the differential pressure by the between differential pressure measuring instrument 8 is set to differential pressure set point between poles deltaP at the time.

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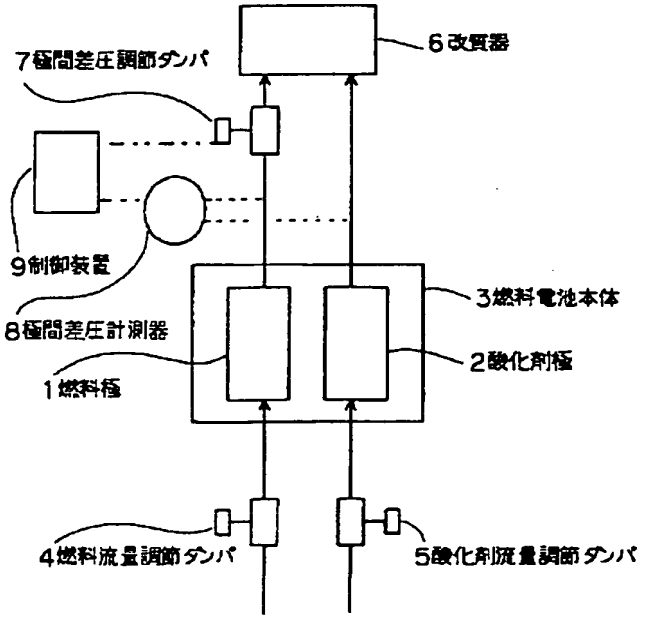

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CLAIMS

[Claim(s)]
[Claim 1] The fuel cell power generating plant characterized by providing the following. The fuel cell main part which consists of a fuel electrode and an oxidizer pole. A fuel-supply means to supply fuel to the aforementioned fuel electrode. A measurement means to have an oxidizer supply means to supply an oxidizer to the aforementioned oxidizer pole, and to measure the differential pressure between the aforementioned fuel electrode and the aforementioned oxidizer pole further. A setting means to set up the proper value of the differential pressure between the aforementioned fuel electrode and the aforementioned oxidizer pole based on both a fuel flow and the oxidizer flow rate which flows the inside of the aforementioned fuel cell main part in the fuel cell power generating plant which has a regulation means to adjust the differential pressur between the aforementioned fuel electrode and the aforementioned oxidizer pole.
[Claim 2] The fuel cell power generating plant characterized by providing the following. The fuel cell main part which consists of a fuel electrode and an oxidizer pole. A fuel-supply means to supply fuel to the aforementioned fuel electrode. A measurement means to have an oxidizer supply means to supply an oxidizer to the aforementioned oxidizer pole, and to measure the differential pressure between the aforementioned fuel electrode and the aforementioned oxidizer pole further. A setting means by which while it was chosen in the fuel cell power generating plant which has a regulation means to adjust the differential pressure between the aforementioned fuel electrode and the aforementioned oxidizer pole from the fuel flow which flows the inside of the aforementioned fuel cell main part, and the oxidizer flow rate sets up the proper value of the differential pressure between the aforementioned fuel electrode and the aforementioned oxidizer pole based on a flow rate.
[Claim 3] The fuel cell power generating plant according to claim 1 or 2 characterized by having the control means which control the aforementioned regulation means so that the differential pressure between the aforementioned fuel electrode and the aforementioned oxidizer pole serves as a proper value set up with the aforementioned setting means.
[Claim 4] The fuel cell power generating plant of any one publication from the claim 1 characterized by having the aforementioned setting means and the single means which serves both as the aforementioned control means to a claim 3.
[Claim 5] The fuel cell power generating plant characterized by providing the following. The fu l cell main part which consists of a fuel electrode and an oxidizer pole. A fuel-supply means to supply fuel to the aforementioned fuel electrode. A measurement means to have an oxidizer supply means to supply an oxidizer to the aforementioned oxidizer pole, and to measure the differential pressure between the aforementioned fuel electrode and the aforementioned oxidizer pole further. A measurement means to measure the differential pressure between the outlet of the electrode of the either the aforementioned fuel electrode or the aforementioned oxidizer pole, and the entrance of the electrode of another side in the fuel cell power generating plant which has a regulation means to adjust the differential pressure between the aforementioned fuel electrode and the aforementioned oxidizer pole.
[Claim 6] The fuel cell power generating plant which has the fuel cell main part which is characterized by to provide the following, and which consists of a fuel electrode and an oxidizer pole, a fuel-supply means supply fuel to the aforementioned fuel electrode, and an oxidizer supply means supply an oxidizer to the aforementioned oxidizer pole, and has further a measurement means measure the differential pressure between the aforementioned fuel electrode and the aforementioned oxidizer pole, and a regulation means adjust the differential pressure between the aforementioned fuel electrode and the aforementioned oxidizer pole. Differential pressure between the outlet of the aforementioned fuel electrode, and the entrance

of th aforementioned oxidizer pole. A measurement means to measure the differential pressure betw en the entrance of the aforementioned fuel electrode, and the outl t of th aforementioned oxidizer pole.
[Claim 7] The fu l cell power generating plant according to claim 5 or 6 characterized by having the control means which control the aforementioned regulation means as the measurement valu measured with the aforementioned measurement means is supervised and this measurement valu is maintained by the proper range.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to improvement of the composition for carrying out monitoring of the between differential pressure very much especially about a fuel cell power generating plant.
[0002]
[Description of the Prior Art] Generally, in the fuel cell power generating plant, from the purpos which performs stable power generation, it has managed so that the differential pressure (very between differential pressure) of a fuel electrode and an oxidizer pole may be uniformly maintained by a certain means. Usually, differential pressure of the outlet of two poles is measured, and a certain means is provided so that the value may be maintained within constant value or a certain fixed limits.
[0003] Drawing 3 is the block diagram showing an example of the conventional fuel cell power generating plant. As shown in this drawing 3 , a fuel cell power generating plant first has the fuel cell main part 3 which consists of a fuel electrode 1 and an oxidizer pole 2, the fuel-flow regulation damper 4 which supplies fuel to a fuel electrode 1, and the oxidizer flow regulation damper 5 which supplies an oxidizer to the oxidizer pole 2. A fuel cell power generating plant has the reforming machine 6 which processes fuel or an oxidizer, the differential pressure regulation damper 7 between poles which is formed in the outlet of a fuel electrode 1 and adjusts between differential pressure very much, and the differential pressure measuring instrument 8 between poles of the outlet of a fuel electrode 1 and the oxidizer pole 2 which measures between differential pressure very much again.
[0004] At the time of operation of the fuel cell power generating plant which has the above composition, fuel and an oxidizer are supplied to the fuel electrode 1 and the oxidizer pole 2 of the fuel cell main part 3, respectively by the fuel-flow regulation damper 4 and the oxidizer flow regulation damper 5. Moreover, premixed combustion of the surplus gas of the fuel cell main part 3 is carried out with the reforming vessel 6. And it is adjusted so that the differential pressure of the pressure of the outlet of the fuel electrode 1 of the fuel cell main part 3 and the pressure of the outlet of the oxidizer pole 2 may be maintained very much within fixed limits by the between differential pressure regulation damper 7, the differential pressure measuring instrument 8

between poles, etc. at the time of such operation. the differential pressure between this pole is specifically called for as differential pressure which deducted the pressur of th oxidiz r pole 2 from the pressure of a fuel electrode 1, and, in the usual case, regulation of the differential pressure between this pole is added slightly (the direction of the pressure by th side of a fuel electrode 1 becomes high) — it is carried out by making it like

[0005]

[Problem(s) to be Solved by the Invention] In the above conventional fuel cell power generating plants, it is comparatively easy to adjust so that between differential pressure may be maintained very much within the limits of [to mean] the cell outlet which is the measure point of the between differential pressure measuring instrument 8 very much.

[0006] However, the differential pressure between poles of a cell outlet is nothing of the parts of the fuel cell main part 3 that is very equivalent to between differential pressure in fact. That is, although the fuel cell main part 3 piles up two or more single cells and is constituted, it differs partially under the influence of the pressure loss of gas rather than cover the whole surface and are uniform. [of the differential pressure between poles of each of that cell side] Although dispersion in the differential pressure between poles in such a cell side changes according to an operation situation, it differs about dozens of mmAqs typically.

[0007] Drawing 4 is explanatory drawing of such a cell side showing an example of a distribution of between differential pressure very much. Ten in drawing expresses the cell of a fuel cell main part. 11 is a fuel entrance, 12 is a fuel outlet, as it is shown in an arrow 13, fuel is introduced in a cell 10 from the fuel entrance 11, and it is drawn from the fuel outlet 12. Moreover, 14 is an oxidizer entrance, 15 is an oxidizer outlet, as it is shown in an arrow 16, an oxidizer is introduced in a cell from the oxidizer entrance 14, and it is drawn from the oxidizer outlet 15. In the usual case, in such a cell 10, the measure point of between differential pressure is the area A1 by the side of the cell outlet side 12, i.e., a fuel outlet, and the oxidizer outlet 15 very much. On the other hand, it sets in such a cell 10, and in the area A2 by the side of the oxidizer outlet 15 on the relation of the pressure loss within a cell, and by the side of the fuel entrance 11, between differential pressure becomes the highest very much, and it becomes the lowest in the area A3 by the side of the oxidizer entrance 14 by the side of the fuel outlet 12.

[0008] That is, in the cell 10 of this drawing 4 , though the differential pressure between poles of the area A1 of a cell outlet side is managed for example, to 50mmAq(s), the differential pressure between poles in area A2 is higher than 50mmAq(s), and it will be low from 50mmAq(s) in area A3. Although between differential pressure has the very ideal thing of a fuel cell which it is added slightly (the direction of the pressure by the side of a fuel electrode 1 becomes high) as mentioned above, when monitoring of the area A1 is carried out in this way, there is possibility of area A3 that between differential pressure will be subtracted very much (the direction of the pressure by the side of the oxidizer pole 2 becomes high).

[0009] Drawing 5 is drawing showing the above trouble from still more nearly another angle, and is a graph which shows an example of each pressure distributions 21 and 22 of the fuel line even from the cell entrance of the fuel cell main part 3 to the reforming machine 6, and an oxidizer line. Here, it is shown as a difference of the pressure of the pressure of a fuel line [in / each part / very / in between differential pressure] and oxidizer line of each part. And very much, the pressure of a fuel line is adjusted by the between differential pressure regulation damper 7, and to be shown in 23 of this drawing 5 , thereby, it is controlled so that the value of differential pressure P1 becomes fixed very between between differential pressure measure points very much.

[0010] However, the differential pressure distribution between poles of a part of cell 10 A1 of a cell outlet side, i.e., the area of drawing 4 , which does not pass to between differential pressure very much, but makes ends the highest value P2 and the minimum value P3 insid a cell 10 has produced differential pressure P1 very in between in this case as mentioned above. In this case, the area A2 of drawing 4 is between differential pressure very much, and the minimum value P3 of the highest value P2 is the differential pressure between poles of the area A3 of drawing 4 . There is possibility that between differential pressure will be [the set point of between differential pressure] partial to a low case subtracted very much especially (the direction of the

pressure by the side of the oxidizer pole 2 becomes high). That is, the minimum value P3 shown in drawing 5 may be subtracted.
[0011] Here, temporarily, when [of a cell side / some] between differential pressure is subtracted very much, in order that property degradation of the portion may progress quickly, between differential pressure must avoid absolutely with a bird clapper t minus very much. However, as long as the differential pressure between poles of the area A1 of a cell outlet side is being controlled, when the rate of flow of an oxidizer goes up in a heavy load especially as mentioned above, the deflection of the differential pressure between poles within a cell has possibility of a large next door and a cell outlet that between differential pressure will be [the between differential pressure set point] local to a low case subtracted very much (the direction of the pressure by the side of the oxidizer pole 2 becomes high). Although the difference of between differential pressure is presumed very much to be the thing within this cell which serv s as about 60 mmAq(s) by the load 70% in a certain example, since [of a between differential pressure measure point (area A1)] it is controlling so that the value of the between differential pressure P1 serves as 50mmAq(s) very much, possibility of a cell outlet side that between differential pressure will be subtracted very much locally is usually very high.
[0012] Moreover, although it is necessary to avoid such a situation absolutely in order for degradation of a cell to progress quickly as mentioned above, if between differential pressure is subtracted very much, it is one of these, and even if between differential pressure is too high very, the life of a cell may be shortened depending on the case. That is, the margin even in consideration of the MAX conditions to which between differential pressure is subtracted very much locally is fully taken, when [of a cell outlet] the between differential pressure set point is set up very much highly, between differential pressure will usually sometimes be made vainly and high very much, and it will have a bad influence on the property of a cell. Therefore, although it is ideal to be added all over a cell and to be controlled as much as possible by the low value moreover as for between differential pressure, in the conventional fuel cell power generating plant as shown in drawing 3 , it is very difficult to perform such ideal control.
[0013] It is being proposed in order that this invention's may solve the above conventional troubles, and the purpose's being able to maintain between differential pressure easily very much in any operation situations to all the ideal low values that are added in respect of a cell, and offering the reliable fuel cell power generating plant which can prevent property degradation of a cell by it.
[0014]
[Means for Solving the Problem] The fuel cell main part with which the fuel cell power generating plant by this invention consists of a fuel electrode and an oxidizer pole, A fuel-supply means to supply fuel to the aforementioned fuel electrode, and a measurement means to have an oxidizer supply means to supply an oxidizer to the aforementioned oxidizer pole, and to measure the differential pressure between the aforementioned fuel electrode and the aforementioned oxidizer pole further, In the fuel cell power generating plant which has a regulation means to adjust the differential pressure between the aforementioned fuel electrode and the aforementioned oxidizer pole, it has the following features to the method which carries out monitoring of the differential pressure between the aforementioned fuel electrode and the aforementioned oxidizer pole.
[0015] The fuel cell power generating plant according to claim 1 is characterized by having a setting means to set up the proper value of the differential pressure between the aforementioned fuel electrode and the aforementioned oxidizer pole based on both a fuel flow and the oxidizer flow rate which flows the inside of a fuel cell main part.
[0016] According to the fuel cell power generating plant according to claim 1 which has the above composition, the next operation is obtained. First, usually, although between differential pressure is managed so that it may be set to about about 50 mmAqs, as mentioned above, the differential pressure between poles managed conventionally is the differential pressure between the poles in the outlet of a fuel electrode and an oxidizer pole, and the differential pressure between poles of each part inside a cell is not strictly very, in agreement. And when the differential pressure between poles in the outlet of a fuel electrode and an oxidizer pole is only managed so that it may be set to about about 50 mmAqs, the differential pressure between

poles inside an actual cell may be subtracted locally.
[0017] On the oth r hand, in invention of a claim 1, between differential pressure can prevent a bird clapper to minus very much locally by calculating the pressure loss produced from the flow rate of fuel and an oxidizer, and setting up the value of the most suitable differential pressure between poles as a proper value in the situation by the setting means. In this case, the most suitable value is the minimum value (minimum) of the value to which between differential pressure is added very much on the whole cell surface at the time of stable operation.
[0018] That is, in this invention, since the proper value of between differential pressure can always be set up very much by the setting means based on the flow rate of fuel and an oxidizer, it becomes possible about the differential pressure between poles of all cell sides plus and to maintain so that it may become minimum by performing management and employment to which the differential pressure between poles in the outlet of a fuel electrode and an oxidizer pole serves as this proper value.
[0019] The fuel cell power generating plant according to claim 2 is characterized by having a setting means by which while it was chosen from the fuel flow which flows the inside of the aforementioned fuel cell main part, and the oxidizer flow rate sets up the proper value of the differential pressure between the aforementioned fuel electrode and the aforementioned oxidizer pole based on a flow rate.
[0020] The same operation can be obtained although according to the fuel cell power generating plant according to claim 2 which has the above composition the precision of a proper value falls a little compared with invention according to claim 1 which sets up the proper value of between differential pressure very much based on the flow rate of both fuel and an oxidizer in order to set up the proper value of between differential pressure very much based on one flow rate of fuel and an oxidizer. However, about the gas of the side which does not measure a flow rate, gas consumption is calculated from current value and it is used for a pressure loss amendment. Especially this invention is more effective than invention according to claim 1, when there are restrictions of a measuring machine machine or cost.
[0021] The fuel cell power generating plant according to claim 3 is characterized by having the control means which control the aforementioned regulation means to become the proper value to which the differential pressure between the aforementioned fuel electrode and the aforementioned oxidizer pole was set with the aforementioned setting means in the fuel cell power generating plant according to claim 1 or 2.
[0022] According to the fuel cell power generating plant according to claim 3 which has the above composition, since between differential pressure is automatically controllable by control means very much, the differential pressure between poles of all cell sides is maintainable so that it may become plus and a minimum always and certainly.
[0023] The fuel cell power generating plant according to claim 4 is characterized by having the aforementioned setting means and the single means which serves both as the aforementioned control means in the fuel cell power generating plant according to claim 1 to 3. According to th fuel cell power generating plant according to claim 4 which has the above composition, an entire plant can be simplified.
[0024] The fuel cell power generating plant according to claim 5 is characterized by having a measurement means to measure the differential pressure between the outlet of the electrode of the either the aforementioned fuel electrode or the aforementioned oxidizer pole, and the entrance of the electrode of another side.
[0025] According to the fuel cell power generating plant according to claim 5 which has the above composition, between differential pressure can prevent a bird clapper to minus very much locally by measuring the differential pressure between a fuel-electrode outlet and an oxidizer pole entrance, or the differential pressure between a fuel-electrode entrance and an oxidizer pole outlet, and performing management and employment from which the measurement value turns into a suitable value by the measurement means.
[0026] That is, when measuring the differential pressure between a fuel-electrode outlet and an oxidizer pole entrance by the measurement means, within a cell since the between differential pressure minimum value will be measured very much, this value can make differential pressure

between poles of all the parts in a cell plus and a minimum by performing plus, and managem nt and employment which become minimum. Moreover, when measuring the differential pressur between a fuel-electrode entrance and an oxidizer pole outlet by the measurement means, since [in a cell] the between differential pressure highest value will be measured very much, evaluation of a stricter fuel cell property and a setup of the operation peak are attained conversely.

[0027] The fuel cell power generating plant according to claim 6 is characterized by having a measurement means to measure the differential pressure between the differential pressure between the outlet of the aforementioned fuel electrode, and the entrance of the aforementioned oxidizer pole, and the entrance of the aforementioned fuel electrode and the outlet of the aforementioned oxidizer pole.

[0028] In the fuel cell power generating plant according to claim 6 which has the above composition, by measuring the differential pressure between a fuel-electrode outlet and an oxidizer pole entrance by the measurement means, within a cell since the between differential pressure minimum value is very measurable, this value can make differential pressure between poles of all the parts in a cell plus and a minimum by performing plus, and management and employment which become minimum. Moreover, by measuring the differential pressure between a fuel-electrode entrance and an oxidizer pole outlet by the measurement means, conversely, since [in a cell] the between differential pressure highest value is very measurable, evaluation of a stricter fuel cell property and a setup of the operation peak are attained.

[0029] The fuel cell power generating plant according to claim 7 is characterized by having the control means which control the aforementioned regulation means as the measurement value measured with the aforementioned measurement means is supervised and this measurement value is maintained by the proper range in the fuel cell power generating plant according to claim 5 or 6.

[0030] The differential pressure minimum value between poles within a cell, or since the between differential pressure highest value or its both are automatically controllable very much, the differential pressure between poles of all cell sides is maintainable according to the fuel cell power generating plant according to claim 7 which has the above composition, with control means so that it may become plus and a minimum always and certainly.

[0031]

[Embodiments of the Invention] Below, the gestalt of two or more operations of the fuel cell power generating plant by this invention is explained with reference to drawing 1 and drawing 2 . In addition, the same sign is given to the same portion as the conventional example shown in drawing 3 , and explanation is omitted.

[0032] [1. Gestalt] of the 1st operation

[1-1. composition] drawing 1 is the block diagram showing the gestalt of one operation of the fuel cell power generating plant which applied each invention of claims 1 and 3 and four publications as a gestalt of the 1st operation by this invention. As shown in this drawing 1 , in the gestalt of this operation, a different point from the conventional example of drawing 2 is a point constituted so that it might have the control unit (control means) 9 which controls the between differential pressure regulation damper 7 very much and this control unit 9 might perform adjustable control of between differential pressure very much. Here, the control unit 9 serves as a setting means to set up the proper value of between differential pressure very much. Moreover, in the gestalt of this operation, very much, very like the conventional plant as between differential pressure, the between differential pressure measuring instrument 8 is constituted so that the differential pressure between poles between the outlets of a fuel electrode 1 and the oxidizer pole 2 may be measured.

[0033] Moreover, it is set up very much fixed as the value with the conventionally fixed between differential pressure set point or the fixed range of the cell outlet of a cell outlet which serves as criteria of management and employment of between differential pressure very much. On the other hand, in the gestalt of this operation, differential pressure set point (very proper value of between differential pressure) deltaP is set up at any time not by fixation but by the control unit 9 according to the following formula (1) very between such cell outlets.

[0034]
[Equation 1]
$\Delta P = C1 - C2 \times (\text{燃料流量})^{C4} + C3 \times (\text{酸化剤流量})^{C4}$

… 式（1）

In addition, in this formula (1), C1 is about 20 mmAq(s) in the value by control width of fac . Moreover, C2 is a pressure loss correction factor by the fuel flow, and is small compared with C3 mentioned later. And C3 is an amendment coefficient about the pressure loss by the oxidizer flow rate, and is a dominant coefficient by this formula. Moreover, C4 is a coefficient related to the flow rate and pressure loss within a cell, and is or more 1 two or less number. In addition, these coefficients are called for by calculation from the pressure loss property of a cell.
[0035] [1-2. operation] According to the gestalt of the 1st operation which has the above composition, the next operation is obtained. First, especially in the conventional fuel cell power generating plant, when the rate of flow of an oxidizer goes up, the deflection of the differential pressure between poles within a cell has possibility of a large next door and a cell outlet that between differential pressure will be [the between differential pressure set point] local to a low case subtracted very much (the direction of the pressure by the side of the oxidizer pole 2 becomes high), as mentioned above. However, in a setup of the differential pressure between cell outlet poles which fully took the margin even in consideration of the MAX condition, usually, between differential pressure will sometimes be vainly made high very much, and it will have a bad influence on the property of a cell.
[0036] On the other hand, in the gestalt of this operation, when the flow rate of fuel or an oxidizer changes, according to the flow rate balance, according to the aforementioned formula (1), differential pressure set point deltaP is called for very between cell outlets, and it is newly set up by the control unit 9. That is, according to change of flow rate balance, between differential pressure set point deltaP changes at any time very much. And a control unit 9 controls the between differential pressure regulation damper 7 in adjustable very much, as the measurement value of the differential pressure measured very much by the between differential pressure measuring instrument 8 is set to differential pressure set point between poles deltaP set up at the time.
[0037] since [thus,] it is automatically controllable so that differential pressure set point between poles (very proper value of between differential pressure) deltaP according to the situation is always set up based on the flow rate of fuel and an oxidizer and the actual differential pressure between poles is set to this differential pressure set point between poles deltaP with a control unit 9 in the gestalt of this operation — all cell sides — very — between differential pressure — always — and — certain — plus — and it is maintainable so that it may become minimum
[0038] a [1-3. effect] — according to the gestalt of this operation as mentioned above — the state (it removes at the time of; transient, such as a load and balance) of what plant — also setting — all the inside of a cell — very — between differential pressure — plus — and it is minimally maintainable Therefore, since the property of a cell is not degraded quickly, the life of a cell can be prolonged and the reliability of a fuel cell power generating plant can be improved by leaps and bounds compared with the former. Moreover, since the control unit 9 which served both as a setting means and control means is used, an entire plant can be simplified.
[0039] [1-4. modification] As a modification of the gestalt of the 1st operation, for example, invention according to claim 2 is applied, and the composition of a cell outlet which asks for between differential pressure set point deltaP very much is also possible based on a fuel flow or an oxidizer flow rate. Thus, although the precision of set point deltaP falls a little compared with the case where it asks for between differential pressure set point deltaP very much based on both a fuel flow and an oxidizer flow rate when constituted, the almost same operation effect as the gestalt of the 1st operation can be acquired. However, about the gas of the side which does not measure a flow rate, gas consumption will be calculated from current value and it will be used for a pressure loss amendment. Thus, since a measuring machine machine can be simplified

when using only one flow rate, when there are restrictions of a measuring machine machine or cost especially, it is more effective than the gestalt of the 1st operation.
[0040] Moreover, in the gestalt of the 1st operation, although the singl control unit 9 which served both as a setting means and control means was used, the composition which uses an individual setting means and individual control means is also possible. Furthermor , in relation to this, as actual d vice structure, a setting means and control means can be incorporated as a part of measurement means or regulation means, or it is possible to constitute the equipment which combined these meanses alternatively etc.
[0041] [2. Gestalt] of the 2nd operation
[2-1. composition] drawing 2 is the block diagram showing the gestalt of one operation of the fuel cell power generating plant which applied each invention of a claim 5 and seven publications as a gestalt of the 2nd operation by this invention. As shown in this drawing 2 , in the gestalt of this operation, a different point from the gestalt of implementation of the above 1st is the connection place of the between differential pressure measuring instrument 8 very much. Very much, although the between differential pressure measuring instrument 8 was connected very much to the outlet of a fuel electrode 1, and the outlet of the oxidizer pole 2 as the gestalt of implementation of the above 1st was shown in drawing 1 , it connects with the outlet of a fuel electrode 1, and the entrance of the oxidizer pole 2, and the between differential pressure measuring instrument 8 consists of gestalten of this operation so that differential pressure in the meantime may be measured. And the control unit 9 is constituted so that the measurement value of the differential pressure from this differential pressure measuring instrument 8 between poles may turn into constant value (20mmAq) set up beforehand, and the between differential pressure regulation damper 7 may be controlled very much.
[0042] [2-2. operation] According to the gestalt of the 2nd operation which has the above composition, the next operation is obtained. First, it is expected that the control amplitude characteristic of the usual stable fuel cell power generating plant which can be set on stream is about **15 mmAqs. Therefore, the indicated value of the between differential pressure measuring instrument 8 is [by controlling the indicated value of the between differential pressure measuring instrument 8 to 20mmAq(s) very much] very maintainable more than Zero mmAq at the time of the usual stable operation. In this case, as for the measure point of the differential pressure between poles in the gestalt of this operation, a measurement value [in / this measure point / within a cell since it is the minimum point of between differential pressure very much] can maintain more than the zero mmAq in all the parts in a cell, as for saying / that it is more than the zero mmAq /. therefore, the thing which between differential pressure is subtracted very much locally (the direction of the pressure by the side of the oxidizer pole 2 becomes high) — it can prevent — all cell sides — very — between differential pressure — always — and — certain — plus — and it is maintainable so that it may become minimum
[0043] [2-3. effect] — according to the gestalt of this operation as mentioned above — the gestalt of implementation of the above 1st — the same — the state (it removes at the time of transient, such as a load and balance) of what plant — also setting — all the inside of a cell — very — between differential pressure — plus — and it is minimally maintainable Therefore, since the property of a cell is not degraded quickly, an electric life can be prolonged and the reliability of a fuel cell power generating plant can be improved by leaps and bounds compared with the former.
[0044] [2-4. modification] As a modification of the gestalt of the 2nd operation, it is for exampl very possible to constitute so that it may connect with the entrance of a fuel electrode 1 and the outlet of the oxidizer pole 2 and differential pressure in the meantime may be measured contrary to the gestalt of the 2nd operation of the between differential pressure measuring instrument 8. Thus, when constituted, within a cell since it becomes the peak of between differential pressure very much, evaluation of a stricter fuel cell property and a setup of the operation peak of the measure point of between differential pressure are attained very much.
[0045] Moreover, invention according to claim 6 applies, and when it constituted so that both the differential pressure of the outlet of a fuel electrode 1 and the entrance of an oxidizer pole 2 and the differential pressure of the entrance of a fuel electrode 1 and the outlet of an oxidizer pole 2

may measure, the operation effect with which the operation effect and the operation effect of the aforementioned modification of the gestalt of implementation of the above 2nd doubl d can acquire.
[0046] It is not limited to the gestalt of each aforementioned implementation, and its modification, and, as for this invention, gestalten various otherwise can be carried [which it is [the gestalt of operation of others /. / 3]] / out within the limits of this invention. For example, in drawing 1 and drawing 2 , although only the composition of the important section in this invention was illustrated roughly, in the actual fuel cell power generating plant, various kinds of devices and systems are used for others. Moreover, concrete composition, such as a fuel cell main part, a fuel-supply means, an oxidizer supply means, a measurement means, a regulation means, a setting means, and control means, is freely selectable.
[0047]
[Effect of the Invention] As explained above, according to this invention, [whether based on a fuel flow or an oxidizer flow rate the proper value of between differential pressure is set up very much, and] Or by measuring the minimum value or the highest value of the differential pressure between poles in a cell In any operation situations, between differential pressure can be easily maintained very much to all the ideal low values that are added in respect of a cell, and the reliable fuel cell power generating plant which can prevent property degradation of a cell can be offered by it.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The block diagram by this invention showing the fuel cell power generating plant of the form of the 1st operation.
[Drawing 2] The block diagram by this invention showing the fuel cell power generating plant of the form of the 2nd operation.
[Drawing 3] The block diagram showing an example of the conventional fuel cell power generating plant.
[Drawing 4] Explanatory drawing showing an example of the differential pressure distribution between poles in the cell side of a general fuel cell.
[Drawing 5] The graph which shows an example of each pressure distribution of a fuel line and an oxidizer line.
[Description of Notations]
1: Fuel electrode
2: Oxidizer pole
3: Fuel cell main part
4: Fuel-flow regulation damper,
5: Oxidizer flow regulation damper
6: Reforming machine

7: It is a between differential pressure regulation damper very much.
8: It is a between differential pressure measuring instrument very much.
9: Control unit
10: Cell
11: Fuel entrance
12: Fuel outlet
13: The flow of fuel
14: Oxidizer entrance
15: Oxidizer outlet
16: The flow of an oxidizer
A1: (between differential pressure is very equal to the differential-pressure measurement valu between poles of a cell outlet) Area
A2: (between differential pressure serves as the highest very much within a cell) Area
A3: (between differential pressure serves as the minimum very much within a cell) Area
21: Fuel line pressure force distribution
22: Oxidizer line pressure force distribution
23: The pressure regulation part according to a between differential pressure regulation damper very much
P1: A between differential pressure measure point is between differential pressure very much.
P2: The interior of a cell is the between differential pressure highest value very much.
P3: The interior of a cell is the between differential pressure minimum value very much.

[Translation done.]

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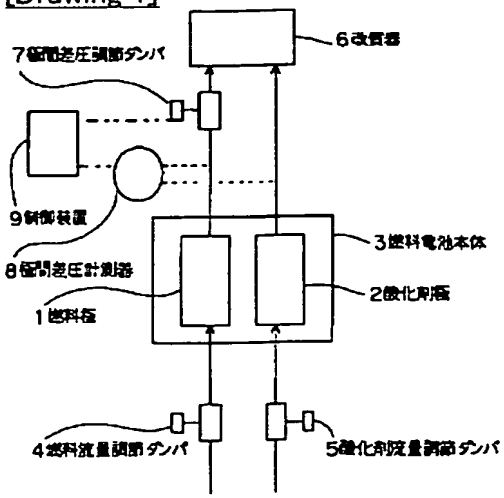
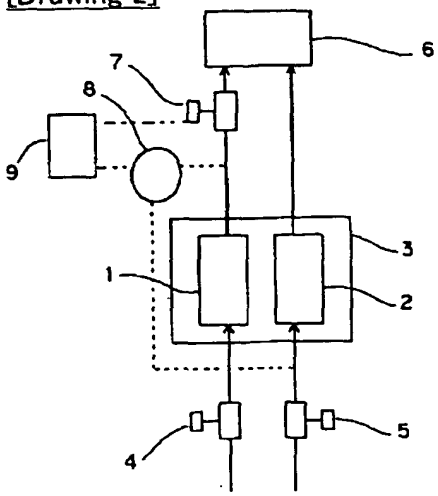
DRAWINGS

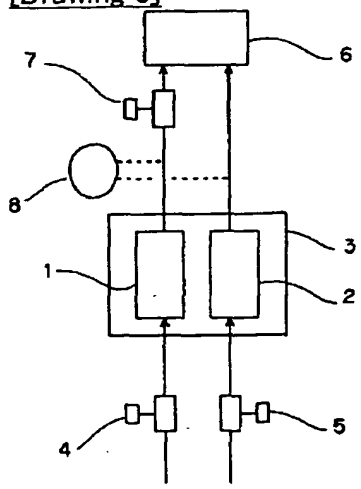
[Drawing 1]



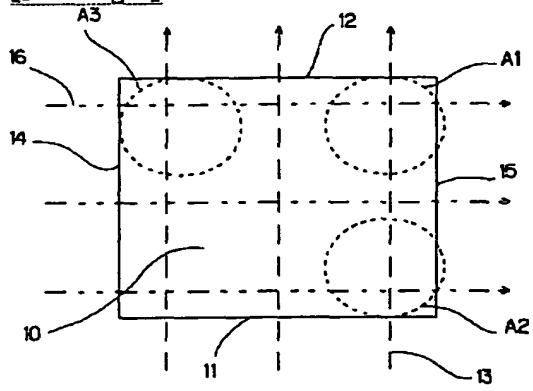
[Drawing 2]



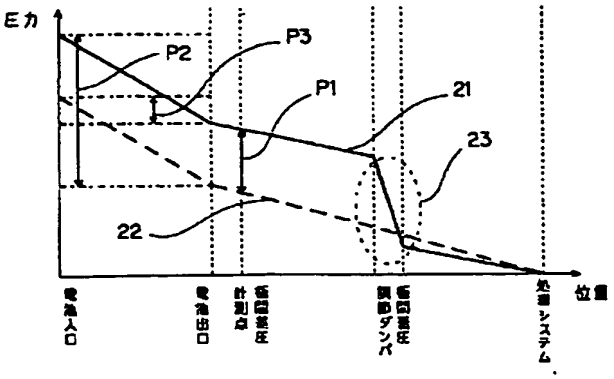
[Drawing 3]



[Drawing 4]



[Drawing 5]



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